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Analysis of the Just in Time Inventory System at UHS Wilson Medical Center

By

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B.A, Binghamton University, 2008

CAPSTONE PROJECT

Submitted in partial fulfillment of the requirements for
the degree of Masters in Public Administration in the Graduate School of
Binghamton University
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Executive Summary

In November 2007, United Health Services Materials Management implemented a Just in Time inventory system to have tighter control of their supply chain. This project examines the accuracy of the par levels currently employed by United Health Services and the financial impact of operating a Just in Time inventory system using inaccurate inventory and par levels. In addition, the project researches other hospitals using JIT inventory management systems to compare implementation and management practices of the JIT process.

A financial analysis conducted on the cost of inventory items along with six interviews of other hospitals utilizing a Just in Time inventory system revealed four major findings. First, the actual inventory levels in the selected cost centers were significantly over the current par levels. The amount the inventory levels exceeded the current par levels varied from a few hundred items to over 1,000 items depending on the JIT tech responsible for that cost center's ordering. Second, the analysis of the past year's usage history data for each selected cost center proved that the current par levels are significantly over pared. Third, the nursing staff is removing the supplies from their designated areas to other locations. Finally, having a strong working relationship and close proximity to the primary vendor are key factors in operating a successful Just in Time Program.

Based on the findings this study offers three recommendations for United Health Services. First, the usage history data needs to be reviewed and assessed quarterly while the par levels should be adjusted annually. Next, a formal staff/nursing education program should be implemented. Lastly, careful consideration should be given to both the proximity of a vendor and the quality of the relationship with the vendor when evaluating new vendors.

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Problem Definition

Hospital Materials Management costs includes the purchase cost as well as any costs incurred with ordering, moving, storing, and paying for the material. The primary aim of materials or inventory management is to reduce these costs of providing a service, while at the same time maintaining the current quality or quantity of service. Hospitals spend roughly $83 billion per year on supplies for their inventory, in which an estimated $11 billion could be reduced through more efficient supply chain management (Scalin, 1997). This makes materials management the second largest cost within a hospital's budget behind only employee salaries and wages (Berling & Geppi, 1989). Due to the increasingly stringent economic atmosphere and increasing political pressure to reform health care practices, many hospital material managers are forced to operate with decreasing budgets and must begin to adopt new and innovative strategies to operate more cost efficiently. With roughly 45 million Americans without health insurance and health care costs continuing to increase, it is imperative for health care organizations to cut operating costs wherever possible. By operating as efficiently as possible, health care organizations will be better suited to serve the influx of newly insured Americans as the health care reform comes into effect.

To begin to address these issues, United Health Services (UHS) implemented a lean management technique in November 2007, known as "just in time" inventory or JIT. In the early 1980's a new concept, known as "zero inventories" was introduced to the American manufacturing industry (Epps, 1995). This "zero inventories" idea required the movement of inventory items from outside vendors to the location where the inventory will be utilized. This process would eliminate operations that do not add value to the organization. This concept of "zero inventories" is now known as Just in Time inventory. Through the implementation of this

process, UHS aimed to reduce their total inventory and the associated costs of managing that inventory.

UHS employed a usage history to determine a par level for each item of inventory. This par level should represent an inventory level where replenishment is necessary. If the par levels are set to low, UHS risks running out of an item. If they are set to high, UHS will have more money invested in stock than needed. Under the JIT system, Buffalo Medical Supply, the primary vendor that now acts as the central warehouse for UHS, makes frequent deliveries throughout the week to supply the hospital. The target goal for UHS was to keep a level of inventory for each item to last 2-3 days. Due to the fact that this was a new system, many of the par levels were guesses based on trial and error and may have been incorrect from the start. Also since the implementation of JIT, there have been changes in the utilization trends, and many of the par values are not representative of the actual usages. Lastly, the skill set and open discretion of the JIT techs, who are responsible for adjusting the par levels, may have lead to inaccurate par levels. As a result of lacking a systematic check and balance system, the par levels remain largely unchanged over time. These inaccuracies extrapolated throughout the UHS system of hospitals may lead to significant financial costs due to the costs associated with unutilized supplies.

Prior to the adoption of a "Just in Time" inventory system, UHS carried about 800,000 dollars in inventory at any one time. After the implementation that amount was able to be reduced to about 440,000 dollars at any one time (personal communication, Keith Jamba, November 7, 2007). Although this represents a significant savings there is still room to increase the efficiency within the system. The ultimate goal of the UHS Materials Management Department is to continue to reduce the amount of inventory stored in their central warehouse to

about 300,000 dollars. Managing inventory inefficiently has the potential to equate to significant losses for hospitals, due to supplies becoming obsolete or being stolen. Approximately 6 percent or 25,000 dollars of UHS hospital's inventory is currently unutilized because they become obsolete or are stolen (personal communication, Keith Jamba, November 8, 2007). In addition, there are costs from supplies that are lost or damaged before they can be utilized. According to Keith Jamba, approximately 1.5 percent or 5,000 dollars of inventory are unutilized because they are lost or damaged prior to use (personal communication, November 18, 2007). Lastly, minimizing inventory through small frequent deliveries can make UHS more responsive to market fluctuations. As prices or quality of supplies fluctuate, hospitals are able to change to comparable but less expensive products or change to improved products or new technology. For instance, when UHS recently switched to a new brand of specimen cups, the price went from $0.74 each to $0.2065 each, and UHS has the potential to save $21,235.434 annually.

Operating a Just in Time inventory system can potentially save a hospital money by managing their supply chain more efficiently; however, there are additional transaction costs that must be accounted for prior to adopting a Just in Time inventory system. According to Keith Jamba, to justify the adoption of this new inventory system UHS evaluated several areas accounting for both hard and soft dollar savings. Hard dollar savings are concrete and identifiable, where a soft dollar savings are those that are realized by not spending. These areas included freight expenses, a onetime reduction in inventory, handling charges, space reallocation benefits, employees, and efficiency (personal communication, Keith Jamba, April 1, 2011). The evaluation determined that the transaction costs of ordering, moving and storing materials under a Just in Time inventory system was less than costs of storing inventory in a warehouse. Although the hard dollar amount for operating a Just in Time inventory system were greater than

storing the materials themselves, the soft dollars that UHS would save was enough to justify the Just in Time implementation.

This project aims to examine the accuracy of the current par values in selected cost centres for UHS Wilson Hospital and to determine the financial impact associated with operating a JIT system using inaccurate inventory and par levels. In addition, the project will research other hospitals using JIT inventory management systems to compare implementation and management practices of the JIT process. This study's major research questions are listed below.

Research Questions

1) What is the accuracy of the current par values in selected cost centres for UHS Hospitals?

2) What is the financial impact in situations where the inventory level is over or under par?

3) How are other hospitals managing their JIT inventory process?

Literature Review

Introduction

Just-In-Time or JIT inventory systems were originally developed in Japan, specifically at Toyota's manufacturing plant. This system was developed as a manufacturing management philosophy and is most common in the automotive industry (Cheng, Podolsky, & Jarvis, 1996). When properly fit into an organizational framework, the JIT manufacturing process has the ability to greatly increase an organizations ability to compete within the market by reducing waste and by increasing the product quality and the efficiency of production (Cheng et al., 1996). Copious research has been conducted regarding JIT manufacturing in the US and abroad. The findings of this research have generally supported that utilizing a JIT inventory system has led to improved operational efficiency and performance (Yasin, Small, & Wafa, 2003). The usage and

impact of JIT within the service sector however, has received significantly less research than its manufacturing counterpart (Yasin, Small, & Wafa, 2003).

Benson's (1986) paper "JIT: Not Just for the Factory" represents one of the initial attempts to describe how JIT could be applied to the service sector. Even with initial literature and studies such as Benson's paper, the service sector still remained largely skeptical of the JIT philosophy. It was not until the mid 1990's that service firms began to accept certain facets of the JIT philosophy (Lai & Cheng, 2009). This reluctance to embrace the JIT philosophy may be attributed to certain challenges organizations face when implementing a JIT inventory system. Included in these challenges is the ability to adopt a JIT inventory system philosophy in its entirety, continued staff education and training, developing a strong relationship with the supplier(s) and the accurate forecasting of demand.

Complete Implementation

Some researchers have contended that a JIT inventory system needs to be implemented as a complete system. In order for a JIT inventory system to be effective, researchers suggest that each part of the system must be implemented at once. Furthermore, the organization must be considered in its entirety with an emphasis on quality, the reduction of waste, and flexibility (Dennision, Kathawala, & Elmuti, 1993; Ramarapu, Mehra, & Frolick, 1995). Fully acknowledging this philosophy may require an alteration of the operating procedures, production and service systems and even the entire organizational culture (Yasin, et al., 2003). For instance Francis (1989) emphasizes the importance of having more precise data, particularly in regards to predicting the demand for an organization to operate a successful JIT inventory system. By situating an organization to better and more accurately collect and forecast demand data, the

organization will be able to efficiently operate with just the right amount of inventory on hand at all times.

Considerations included in a JIT inventory system implementation have both internal and external factors. The internal factors are those involving product, equipment and process, human resources, and senior management commitment (Ahmed, Tunc, & Montango, 1991). The external factors focus on the customers and the vendors. Of the aforementioned internal factors, education and training of the employees are two of the most crucial elements for a successful JIT system (Yasin, et al., 2003; Minahan, 1996).

Staff Training/ Education

Integrating a continuous education and training program for both the staff and management will allow the organization to be confident that their human resources completely understand the JIT philosophy and the new culture associated with this philosophy (Gupta, Holladay, & Mahoney, 2000). Through the education and training process, it is important to present what each employee's role is, what will be required of them, and how their conduct will ultimately affect the organization's success. This training gives employees the resources to recognize and solve problems that are affecting the organizations efficiency (Canel, Rosen, & Anderson, 2000). Organizations with successful JIT programs often offer on the job training as well as in class training to fully inform their employees (Gupta, Holladay, & Mahoney, 2000). Since the health care sector has had to contend with increasing financial constraints implementing a JIT inventory system has become an increasingly popular option. There are many benefits of implementing a JIT inventory system in hospitals. However, there are several factors that cause apprehension in this consideration, due to the characteristics associated with hospital work. A primary issue hospitals face when implementing a JIT inventory system is the

fluctuating demand inherent to the health care field (Neil, 2004).

Demand Forecasts

A hospital, unlike a manufacturing plant, cannot determine with any amount of confidence the demand for its services; one week it may be operating at 50 percent capacity and the next at 100 percent. Operating a JIT inventory system under these conditions can impose a risk for the hospital when the demand suddenly increases (Kua-Walker, 2010). It is of utmost importance to accurately determine usage patterns and reevaluate these patterns over time. The JIT process must constantly be analyzed to catch the fluctuation in demand (Baum, 2006). As noted by the Seattle Children's Hospital (2010), data visibility was imperative to the immediate success of their implementation. This was achieved by utilizing an on screen dashboard to monitor usage patterns, which allowed the organization to quickly adjust to either an increased or reduced inventory level quick enough to maintain an optimal inventory level. A JIT inventory system can constantly be honed as long as there is accurate information to do so (Richardson, 1987). The fact that receiving a hospital's service can be a matter of life and death, it is paramount that the inventory levels are carefully and continually managed to avoid a stockout (Baum, 2006). A stockout is an instance where an inventory item is needed but is not available in the current inventory. However to address these issues, hospitals can maintain a separate reduced inventory to act as a safety net.

Supplier Relationship

Next hospitals must develop an exceptional working relationship with their supplier and create emergency plans to deal with a sudden increase in demand. It is important to have relatively few suppliers so that both parties can fully commit to the relationship (Dennision, Kathawala, & Elmuti, 1993). Open communication is essential and suppliers should be viewed as

a vital part of the organization (Dennision, Kathawala, & Elmuti, 1993). By having these contingency plans in place material managers are able to utilize a JIT inventory system without the fear of running out of supplies (Kua-Walker, 2010).

Summary of the Literature

Overall, implementing a JIT inventory system cannot be viewed as a one-size-fits-all system; every hospital functions slightly differently and has its own nuances. As stated in much of the literature, a JIT system offers many benefits over the long term, but the pre-implementation planning is vital in the realization of a fully functional system (Kua-Walker, 2010). It is crucial for a hospital to continually monitor and analyze demand patterns and trends to adjust inventory levels. In addition, it is essential to carefully select an appropriate supplier and develop and maintain an excellent working relationship. Perhaps the most important factor in the successful implementation of a JIT inventory system is staff education and training. With meticulous planning and constant monitoring and modification a JIT inventory system can decrease a hospital's cost while increasing its productivity (Kua-Walker, 2010).

Methodology

Data Collection

To address the research questions proposed in this project this study utilizes a mix of quantitative and qualitative data from both primary and secondary sources. Data regarding the management of other hospitals utilizing a Just-In-Time inventory system was identified and compiled through a series of six phone interviews with hospital administrators. Prior to conducting the interviews this project was reviewed and approved by the Binghamton University's Human Subjects Research Review Committee (see appendix B). The hospitals selected for these interviews included four hospitals currently using Buffalo Medical Supplies,

the same primary vendor utilized by UHS, and two hospitals using different vendors. To identify the four hospitals using Buffalo Medical Supply, a list of hospitals that are members of the same voluntary hospital association (VHA) as UHS, was sent to Buffalo Medical Supply. From this list they were able to inform UHS as to which of those members currently use Buffalo Medical Supply as a primary vendor for Just-In-Time. The two other hospitals not utilizing Buffalo Medical Supply as a primary vendor were selected through Keith Jamba's, Director of Materials Management for United Health Services, contact lists.

The interviews were conducted using nine open ended interview questions (see appendix A). Each of the six hospital administrators was presented the same open-ended interview questions. By leaving the questions open ended it allowed each individual manager to discuss points or issues relating to the questions that they felt were pertinent.

Quantitative information regarding the accuracy of inventory levels compared to the current par levels and the financial impact associated with operating a Just-In-Time inventory system using inaccurate par levels were identified through secondary sources. Three of the cost centers at UHS Wilson Medical Center were chosen to determine the accuracy of the par levels. The cost centers were selected by Bernie Tronkowski, UHS Material Management Supervisor. UHS Wilson Medical Center currently employs three JIT techs, so the cost centers were chosen based on the fact that each cost center chosen is the responsibility of one of the three techs. After the three cost centres were selected, each item of inventory was individually counted and compared to the current par level. In addition, a usage history report was run to determine a one year (3/1/10-2/28/11) average for each item. From this average, a 3 day inventory level was determined and then compared to the current par level.

Data Analysis

During the each of the seven phone interviews, detailed notes were documented for each response. Any further insight into the interview questions offered by the interviewee was also documented as long as it pertained to the scope of the study. After each interview was complete, the responses for each question were thoroughly analyzed to determine trends. Once this analysis was completed the major themes were compiled as common Just in Time management practices.

Through the use of UHS's materials management information system or MMIS the hospital is able to run a report to show the current usage levels of each inventory item. A one year average from March 1, 2010 to February 28, 2011 for each item was determined through these monthly reports. This average was then converted into an average daily use and multiplied by three to represent UHS's desired 2-3 day inventory level. This new average now represents the level at which the par for any particular item should be set. Each of the current par levels for each item of inventory is then compared to the new par level. If an item's current par level is over or under the new average usage (new par) then the value of that item is multiplied by the amount it is over or under pared. For example, if a particular item was over pared by two units and the item cost United Health Services 5 dollars each to purchase, then UHS would be able to reduce their held inventory by 10 dollars. An item that was over pared was represented by a positive number, and an item that was under pared was represented by a negative number. Items that the par level equals the new average usage received a value of zero, and no adjustments were necessary. In addition to reviewing the new usage patterns, a financial analysis was also conducted to determine the impact where the JIT techs ordered inventory for the selected cost centre over the current par levels. Each inventory item was individually counted and compared to

their respective par level currently set. For instance, if the inventory item costs 2 dollars and was set to have a par level of 10 and there are 20 items stocked on the unit, the financial impact was 2 dollars multiplied by the 10 items it is over the par level. After all the selected cost centres were evaluated the results were tabulated to determine how much value UHS is over or under the current par levels and how much the JIT techs are over stocking the units.

Limitations

Time constraints for this study posed a significant limitation. In particular, there was only time to conduct 6 interviews. If there had been time to conduct additional interviews it would have created a broader source of information to compare Just in Time management practices from. In addition, due to the geographic location of the hospitals it was not feasible to conduct an onsite interview. This limited the study because as discussed in the literature, an important aspect of a successful Just-In-Time inventory system is a complete implementation of its philosophy throughout the organization. Included in a complete implementation is integration into the organizational culture present at each of these hospitals. By not being able to observe the culture present at the locations first hand it made it difficult to obtain a full understanding regarding this aspect of a Just-In-Time implementation. Further, the financial analysis was limited to a very simplistic analysis based solely on purchase costs due to the same time constraints. The analysis does not account for the other cost associated with operating a Just-In-Time system with inaccurate pars. These costs include any costs incurred with ordering, moving, storing, and paying for the material.

Findings

Through the financial analysis and interviews conducted in this study, there were four major findings. First, the actual inventory levels in the selected cost centres were significantly over the current par levels. The amount the inventory levels exceeded the current par levels varied from a few hundred items to over 1,000 items depending on the JIT tech responsible for that cost centre's ordering. Second, the analysis of the past year's usage history data for each selected cost centre proved that the current par levels are significantly over pared. Third, the nursing staff is removing the supplies from their designated areas to other locations. Finally, having a strong working relationship and close proximity to the primary vendor are key factors in operating a successful Just in Time Program.

Finding One: There is a wide range of inventory accuracy maintained relative to the current par levels, and the current par levels do not match actual usage levels.

As previously mentioned, each cost center analyzed is maintained by a different JIT tech. The analysis of North Tower 3's inventory revealed that the floor's inventory was over its combined par level by 1,453 items for a value of $779.58. Of the 84 inventory items included in the analysis of North Tower 3, only 5 items had inventory levels that fell under the currently assigned par levels. There were 20 items that had inventory levels equal to the current par level and there were 59 items that were over the current par level. The analysis of the CCU (coronary care unit) was over the combined par level by 1,188 items for a value of $1193.83. This cost centre had 77 inventory items included in the analysis. Of these 77 items, only 6 items had inventory levels under the current par levels, 18 items had inventory levels equal to the current par levels and 53 items had inventory levels over the current par levels. Lastly, the analysis of South Tower 3 showed that the unit was only over the combined par level by 379 items for a

value of $332.58. Of the 77 inventory items, 7 items had inventory levels below the current par levels, 29 inventory items had inventory levels equal to the current par levels, and 41 items were over the current par levels. The financial impact of the three selected cost centres for United Health Services due to inventory levels over the current par levels totaled $2,305.99.

Following the analysis of the current par levels, the usage history data was reviewed to develop new par levels. Once these new par levels were developed they were compared to the current par levels for each selected cost centre. The new par level for North Tower 3 would allow a net reduction of the current par levels by 338 items which equates to a reduction of $843.67 of inventory. Next, the usage history for the CCU showed that the current par levels could be reduced by 482 items for an $871.57 reduction. Lastly, the usage history showed that South Tower 3 could reduce the par levels by 423 items for a value of $883.26. The total financial impact for operating with par levels that are not based on the actual usage level for the three cost centres is $2,598.50.

The total potential savings or financial impact of operating the three cost centres analyzed in this study using inaccurate par levels and overstocked inventory is equivalent to the dollar value of inventory stocked over/under the current par level plus the dollar value of the amount the current par level is over/under the newly determined par level. The total impact for: 1) North Tower 3 is $1,623.25; 2) South Tower 3 is $1,215.84; and 3) CCU is $2,065.39. The combined total for the three cost centers is $4,904.48. By averaging the total impact for each of the three cost centres analyzed and multiplying it by 24, the total amount of cost centers in the hospital, the total financial impact roughly estimated for the entire hospital would be $39,235.84. This represents approximately ten percent of the total inventory.

Table 1
Inventory/Par level
Accuracy

Cost Center	Items Over Par	Financial Impact	Percent of Total Inventory	Amount Current Par is Over New Par	Financial Impact	Percent of Total Inventory	Total Financial Impact
North Tower 3	1,453	$779.58	0.18	338	$843.67	0.19	$1,623.25
CCU	1,188	$1,193.83	0.27	482	$871.57	0.2	$2,065.40
South Tower 3	379	$332.58	0.08	423	$883.26	0.2	$1,215.84
Total	3,020	$2,305.99	0.53	1243	$2,598.50	0.59	$4,904.49

Finding Two: Nursing staff is removing supplies from designated supply areas causing inaccurate usage levels.

When counting the inventory items in the CCU, an area was accidently discovered where nursing staff had removed inventory items from the designated stock areas and stored them in a cabinet. If inventory items are not kept in the designated areas, the JIT techs must assume those items are being utilized. By making this assumption, usage levels are overestimated which causes the hospital to hold unnecessary inventory. However, due to the nature of this problem the exact impact is not able to be determined through this study. This is a problem that three of the six hospital administrators noted in the interviews. As noted by Charles Burgess of Erie County Medical Center, "nursing moves the supplies around and puts them in a different order away from the item's label and par level making it difficult to track the items."

Finding Three: **Staff education/training is important in maintaining accurate levels of inventory and reviewing usage history reports help match demand fluctuations.**

As the previous finding illustrates, staff education/training is essential to managing a successful Just in Time process. A material manager and an SPD Supervisor in two different hospitals included in this study also stressed the importance of educating the Just in Time staff and the end users such as the nursing staff to reduce incidences where techs or nurses stock to much inventory to reduce their workload or order frequency or because they fear running out of necessary inventory. Charles Burgess of Erie County Medical Center stated that "nursing education is key to maintaining low levels of inventory." The JIT techs and nursing staff are the ones who ultimately have the power to follow the par levels set by the administration because they are the ones who check and use the inventory daily as well as place the orders to replenish used supplies. Of the 6 hospitals interviewed, all 6 leave the task of ordering up to either the JIT techs or the nursing staff; however, none of them have a formal staff education or training program to teach them what each employee's role is, what will be required of them, and how their conduct will ultimately affect the organization's success. Each interviewed organization's education solely consists of the initial training upon hiring and occasional on the job training.

Two of the administrators interviewed in this study whose inventories were at the desired level consistently ran and reviewed usage history reports. For example, Roswell Park Cancer Institute runs reports to show what inventory levels need to be changed either monthly or quarterly depending on which cost center they are looking at. On the other hand, an administrator from Erie County Medical Center, Charles Burgess, said that the inventory levels are not down to the level that they prefer, and that they have to work and fine tune the levels. He stated that the nursing staff are the ones who debate what the levels should be set at and "they want what they

want and they justify it by saying they need it to save patients lives. We need to have more authority over the inventory levels and be more number driven"

Finding Four: A strong working relationship with a vendor and having a vendor that is in close proximity to the Hospital are important factors in managing a successful Just in Time process.

In addition to staff education/training, maintaining a strong working relationship and having a vendor in close proximity are important to successful Just in Time management. Of the six administrators that were interviewed all but one administrator either stated that when choosing a vendor, the deciding factor was the close proximity of the vendor or the fact that they already had a working relationship with the vendor. In addition, five of the six hospitals indicated that their relationship with their vendor was successful.

When it came time to decide on a primary vendor, three of the six administrators stated a major reason for choosing their vendor was that prior to implementing a Just in Time inventory system they had already built a solid working relationship with that vendor. For instance, John Hanlon from Wyoming Valley Health Care stated that prior to implementing a Just in Time process they worked with Owens and Minor, so when it came time to choose a vendor they knew they "already had a relationship built and because of this the partnership is very successful."

Another theme revealed through the administrator interviews was that vendor proximity was an important factor in choosing a vendor. Of the six administrators interviewed, three stated that having a vendor that is located in close proximity to the hospital is key to the success of the Just in Time inventory system. Charles Burgess of Erie County Medical Center stated that "availability and the fact they are a local operation were major factors in choosing Buffalo Medical Supplies."

Recommendations

In light of the aforementioned findings, this capstone paper makes three recommendations for United Health Services. First, the usage history data needs to be reviewed and assessed quarterly while the par levels should be adjusted annually. Next, a formal staff/nursing education program should be implemented. Lastly, careful consideration should be given to both the proximity of a vendor and the quality of the relationship with the vendor when evaluating new vendors.

Recommendation One: Review and assess the usage history data quarterly and adjust par levels annually.

As the financial analysis has shown, since the implementation of the Just in Time process at UHS the par levels that were originally set are in need of adjustment to meet the new demand trends. UHS should run usage history reports for the remaining cost centres for both UHS Wilson Medical Center and UHS Binghamton General. After these reports are run, they should translate the usage history data into a 3 day par level based off the average usage, as was done for this study. Once these new par levels are determined for each cost centre, they need to be posted in place of the current par levels. To operate their Just in Time inventory system at the most efficient level possible UHS should monitor and adjust their par levels in accordance to their usage history patterns. The usage history reports should be run on a quarterly basis and continually reviewed for any fluctuation in demand. The par levels should be adjusted annually to mirror the demand as closely as possible. This study's examination of the usage history patterns for the past year (2/28/11- 3/1/10) revealed that the current par levels were significantly inaccurate.

Recommendation Two: Implement a formal education or training program for not only the JIT techs but the nursing staff as well.

As the findings show, the person responsible for replenishing utilized inventory back to the set par levels has the discretion to keep the inventory levels at the par levels or not. UHS can run usage history reports and adjust the par levels every day, but if the JIT techs do not understand the ramifications of restocking over the designated par levels they are going to continue to order excess supplies. The materials management department needs to work towards having more authority over the inventory levels.

Nursing education and buy in are key in this endeavor as they must understand that they will not run out of supplies and that the par levels are not arbitrarily set but in fact are being set in accordance to the usage reports. Even after education, there needs to be administrative oversight to make sure the techs are maintaining the appropriate inventory levels represented by the par levels. In addition, educating the nursing staff and other end users of the Just in Time process will inform them as to how the process works and what implications certain activities such as, hoarding supplies or moving items from designated areas, has on the system. Implementing an on-the-job training program as well as an in class training for both the JIT techs and the nursing staff will give these employees a clear understanding of their specific role in the process. A training and education program will also give the personnel the resources and understanding to recognize possible inefficiencies, problems, or opportunities for improvement within the system. Further it will help to ease the fears of running out of supplies that many of the staff currently may fear.

Recommendation Three: Examine vendor proximity and relationship when considering a new vendor.

Once the Novation (GPO) contract expires and UHS begins to examine other possible vendor options, the proximity of the vendor and the relationship with the vendor are important factors to consider. As the findings show, having a good working relationship and close proximity to the vendor aids in the successful management of the Just in Time process. Due to this, proximity and relationship with the vendor need to be examined thoroughly when choosing a future vendor.

Conclusion

A Just in Time inventory system is a viable option for hospitals looking for innovative strategies to better control their supply chain. However, there are numerous challenges associated with operating this type of inventory system within a hospital setting. As this study has revealed, there are financial impacts associated with stocking items over the determined par level and operating the system with inaccurate par levels. Factors such as, complete implementation, staff education/training, forecasting demand, and the supplier relationship are areas that need to be managed closely to run a successful Just in Time inventory system. With careful planning and continuous monitoring and adjustments, a Just in Time inventory system can decrease hospital's costs through more efficient supply chain management.

Resources

Ahmed, N., Tunc, E. & Montagno, R. (1991). A comparative study of US manufacturing firms at various stages of just-in-time implementation. *International Journal of Production Research*, *29*, 787 – 802.

Baum, N. H. (2006). 'Just in time' means more dimes in your pocket: Stocking only what your practice needs takes careful planning, but offers big savings. *Urology Times, 34*, 28.

Benson, R. J. (1986). JIT: Not just for the factory. *Proceedings from the 29th Annual International Conference for the American Production and Inventory Control Society* (370-374).St Louis, MI.

Berling, R.J. and Geppi, J.T. (1989). Hospitals can cut materials costs by managing supply Pipeline. *Healthcare Financial Management*, 43, 19-25.

Canel, C., Rosen, D., & Anderson, E. A. (2000). Just-in-time is not just for manufacturing: a service prospective. *Industrial Management & Data Systems, 100*, 51-60.

Cheng, T. C. E., Podolsky, S., & Jarvis P. (1996). Just-in-time manufacturing: an introduction. Great Britian: The University Press.

Dennision, R., Kathawala, Y., & Elmuti, D. (1993). Just-in-time: Implications for the hospital industry. *Journal of Hospital Marketing, 8*, 131-141.

Epps, W. R. (1995). Just-in-time inventory management: implementation of a successful program. *Review of Business, 17, 40-44.*

Francis, J. Q. (1989). Building a practical jit program. *Traffic management, 28*, 55-60

Gupta, M., Holladay, H., Mahoney, M. J. (2000). The human factor in jit implementation: A case study of the ambrake corporation. *Production & Inventory Management Journal, 41*, 29-33.

Kua-Walker, Y. A. (2010). Can a just-in-time inventory system help reduce costs and increase productivity in hospitals? Unpublished manuscript, Department of Accounting, California State University, Sacramento.

Lai, K., & Cheng, T.C. (2009). *Just-in-time logistics.* England: Gower Publishing Limited.

Minahan, T. (1996). Jit: How buyers changed it. *Purchasing, 121*, 36.

Neil, R. (2004). The ups and downs of inventory management. *Materials Management in Health Care, 13*, 22-26.

Ramarapu, N. K., Mehra, S., & Frolick, M. N. (1995). A comparative analysis and review of JIT "implementation" research. *International Journal of Operations & Product Management, 15*, 38-49.

Richardson, J. (1987). Just-in-time inventory: A practical application. *Hospital Material Management Quarterly, 9*, 83-86.

Scanlin, T. (1997). A case for 'just in time': could it be right for your hospital, too? *Journal of Healthcare Resource Management,* 15.

Seattle children's hospital saves $2.5 million in first year with streamlined inventory distribution. (2010). Retrieved from http://www.hfma.org/HFMA-Initiatives/Healthcare-Financial-Pulse/Cost-and-Quality/Seattle-Children%E2%80%99s-Hospital-Saves-$2-5-Million-in-First-Year-with-Streamlined-Inventory-Distribution/

Yasin, M. M., Small, M. H., & Wafa M. A. (2003). Organizational modifications to support jit implementation in manufacturing and services operations. *Omega, 31*, 213-214.

Appendix A
Interview Questions

1. How many years has your hospital been utilizing a Just-In-Time inventory system?

2. Who is your primary vendor/distributor?

3. How and why did you choose this distributor? Has it been a successful partnership and if you had to do it over, what would you do differently?

4. What Materials Management Information System do you use?

5. How have your stockroom inventory levels been effected by the Just-In-Time implementation? What was your reduction in inventory initially upon implementation and have you been able to maintain that level at minimum?

6. How and how often are the par levels reviewed at each location to determine accuracy?

7. Is there a formal Just-In-Time education/training program in place? If so, is it one time or continuous?

8. Would you be willing to share your education/training program of staff? If yes, what is your education/training process?

9. What are your biggest challenges using Just-In-Time and how do you address these challenges?

Appendix B
Human Subjects Protocol Approval

Date: February 28, 2011

To: Kyle Roeber, CCPA

From: Anne M. Casella, CIP Administrator
Human Subjects Research Review Committee

Subject: Human Subjects Research Approval
Protocol Number: 1629-11
Protocol title: JIT Inventory System: A managerial process

Your project identified above was reviewed by the HSRRC and has received an Exempt approval pursuant to the Department of Health and Human Services (DHHS) regulations, 45 CFR 46.101(b)(2) .

An exempt status signifies that you will not be required to submit a Continuing Review application as long as your project involving human subjects remains unchanged. If your project undergoes any changes these changes must be reported to our office prior to implementation, using the form listed below: http://humansubjects.binghamton.edu/2009_Forms/012_Modification%20Form.rtf

Principal Investigators or any individual involved in the research must report any problems involving the conduct of the study or subject participation. Any problems involving recruitment and consent processes or any deviations from the approved protocol should be reported in writing within five (5) business days as outlined in Binghamton University, Human Subjects Research Review Office, Policy and Procedures IX.F.1 Unanticipated Problems/adverse events/complaints. We also require that the following form be submitted:
http://humansubjects.binghamton.edu/Forms/Forms/Adverse%20Event%20Form.rtf

University policy requires you to maintain as a part of your records, any documents pertaining to the use of human subjects in your research. This includes any information or materials conveyed to, and received from, the subjects, as well as any executed consent forms, data and analysis results. These records must be maintained for at least six years after project completion or termination. If this is a funded project, you should be aware that these records are subject to inspection and review by authorized representative of the University, State and Federal governments.

Please notify this office when your project is complete by completing and forwarding to our office the following form: http://humansubjects.binghamton.edu/Forms/Forms/Protocol%20Closure%20Form.rtf Upon notification we will close the above referenced file. Any reactivation of the project will require a new application.

This documentation is being provided to you via email. A hard copy will not be mailed unless you request us to do so.

Thank you for your cooperation, I wish you success in your research, and please do not hesitate to contact our office if you have any questions or require further assistance.

Appendix C
Letter of Agreement

Letter of Agreement

February 23, 2011

To the Binghamton University Human Subjects Research Review Committee:

I am familiar with Kyle Roeber's research project entitled Just-In-Time Inventory Systems: The Management Process. I understand United Health Services' involvement to provide a list of contacts from other members of a voluntary hospital association United Health Services participates in and provide initial contact before the phone interviews take place.

I understand that this research will be carried out following sound ethical principles and that participant involvement in this research study is strictly voluntary and provides confidentiality of research data, as described in the protocol.

Therefore as a representative of United Health Services, I agree that Kyle Roeber's research project may be conducted at our institution.

Sincerely,

Keith Jamba

Keith Jamba